

Phenomena
European Pine Shoot Moth

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WORK PLAN
for
EUROPEAN PINE SHOOT MOTH
SEX ATTRACTANT TRAP SURVEYS, 1968

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The European pine shoot moth was first discovered in the western United States at Seattle, Washington in 1959. Despite efforts to contain the moth to the Puget Sound area, spot infestations have been found throughout Oregon and Washington and at Berkeley, California. Many of these outbreaks have been eradicated and efforts are underway to eradicate or control the remainder.

Moth detection surveys used to measure the effectiveness of these programs are a vital but costly part of the control effort. Visual examination of each individual bud on ornamental pines is time consuming and costly and it is impractical, if not impossible, to examine all buds in a dense native pine stand.

The development of a male moth trap which is baited with a sex attractant extracted from the abdomen of virgin female moths appears to be a practical and efficient tool to supplement the visual surveys. These traps are placed where there is reason to believe a very low population of the shoot moth may be present. They have proved successful in trapping moths in areas of heavy host type where several hours visual inspection failed to find any infested shoots.

OBJECTIVES OF SURVEY

There will be five main objectives to surveys conducted with sex attractant traps during 1968:

1. In several areas outside the Containment Zone where outbreaks of shoot moth were found, eradication has been attempted. In these areas attractant traps will be used in addition to visual surveys to determine if eradication of the moth has been successful.
2. In two areas outside the Containment Zone where isolated outbreaks of the moth have been found there is no threat

to native pine stands. In these areas chemical reduction of the moth population is being attempted. Attractant traps will be used in these areas to measure the residual moth population.

3. In areas adjacent to outbreaks at Walla Walla and Shelton in Washington, there is a chance that the moth may have become established in native pine stands. Attractant traps will be located in these pine stands in an attempt to detect any infestation that may be present.
4. In an isolated small infestation in three trees at Prosser, Washington attractant traps will be used in an attempt to reduce or eradicate the small moth population now present.
5. In a Christmas tree plantation with a high moth population at Tumwater, Washington, attractant traps will be kept in operation throughout the moth flight to test their effectiveness. Information will be collected to determine the effective period of the traps.

Table 1.--Attractant trap locations, numbers and use for 1968

Location	: Number : : traps :	Weeks in : : operation :	Objective
Walla Walla	3	4)	Evaluate results of eradication program.
College Place	3	4)	
Hermiston	25	4)	Evaluate results of chemical control program.
Kennewick	3	4)	
Shelton	6	4)	Detection survey for possible escape to native pines.
Walla Walla	6	4)	
Summerland	6	4)	
Prosser	10	8	Eradication attempt.
Tumwater	3	8)	Evaluation of traps.
Victoria	4	4)	

RESPONSIBILITIES AND ORGANIZATION

Planning - This plan for use of shoot moth attractant traps for 1968 has been prepared by the U. S. Forest Service in cooperation with the State of Oregon Department of Forestry and the Washington State Department of Natural Resources.

Supervision - The collection of infested shoots and the preparation of the attractant will be supervised by an employee of the Washington State Department of Natural Resources. Selection of trap locations and operation of the trapline will be supervised by David McComb, U. S. Forest Service.

Personnel - The Washington State Department of Natural Resources will employ personnel to make the collections of shoot moth-infested material and to rear and prepare the attractant from these moths. They will also supply the personnel to operate the traplines in Washington, including the traps at the eradication attempt at Prosser. The Oregon Department of Forestry may operate the traplines in Hermiston, Oregon.

Training - Training on the procedures to be used in the rearing of moths, preparation of attractants, and operation of traplines will be by the U. S. Forest Service.

Facilities - The Washington State Department of Natural Resources will provide in the Seattle area space for the rearing of moths and the preparation of the sex attractant. Two rooms with proper heat and light will be required from May 15 through July 15, 1968.

Financing - Cost of collection of infested shoots, rearing of moths and preparation of the attractant will be paid by the U. S. Forest Service. The cost of the operation of the traplines will be paid for by each agency for which specific traps are operated.

Canadian - Traps and attractant baits will be supplied to the Canadian Department of Forestry and Rural Development Stations at Vernon and Victoria, British Columbia. These traps will be operated at Summerland, B.C. to investigate the possibility of a moth infestation in a native pine stand and at Victoria in an infested area to evaluate the use of these traps in Canadian shoot moth surveys.

Personnel Requirements - A laboratory supervisor will be required from approximately May 15 until July 15. This individual will first be responsible for the collection of the moth-infested shoots. He will then supervise the laboratory aids in the rearing of moth larvae, sexing of pupae, and collection of the sex attractant. He will be responsible for the preparation of the attractant solution and making of the trap baits. This individual will be required to qualify to drive a State vehicle.

Four to six part-time laboratory aids will be required. Their exact number will depend on the number of hours they are available for work. It is estimated that it will take from 600 to 700 hours to complete the moth rearing, pupae sexing, and attractant preparation. This work will start about May 20 and end about July 10. Three aids should be hired to start and the others added when required.

One field man will be required to service the trapline and should be available for duty as required between June 15 and August 15. When all the traps are in operation he will be required to qualify to drive a State vehicle and may have to remain in travel status two or three nights each week.

Work Area - Space will be required to store infested shoots until they are placed in rearing. These shoots will be placed in several hundred milk shake containers until the larvae pupate. This will require considerable table space. Table space will also be required for sorting and moth sexing, plus storage of pupae vials. A minimum of 200 square feet of floor space will be required. This can be in one or more rooms which should be well lighted with extra electrical outlets available. Heated space would be preferred; if not, wiring for electric heaters to hasten moth development should be available.

Since experienced help is available from students at the University of Washington and cold-storage space is also present at the Forestry School, it would be advisable to have the work area in the University District. It should not be outside the general area from which the infested shoots will be collected.

Equipment - The equipment and materials required in the preparation of the attractant and the traps will be supplied by the U. S. Forest Service. Transportation equipment will be supplied in Washington by the Department of Natural Resources and in Oregon by the Department of Forestry.

Equipment Requirements -

Bags, plastic, large	100
Bags, plastic, small	100
Containers, quart milk shake	1,000
Lids, clear plastic for above	1,000
Containers, quart ice cream	100
Pruning clippers	6
Plugs, dental cotton	500
Scissors, needle nose	3
Forceps, vacuum pickup kit	1
Forceps, fine	12
Needles, dissecting	12
Roll heavy cord	1
Roll copper wire	1
Vials, plastic	500
Microscope	1
Light, microscope	1
Lamp, high intensity	1
Lamps, desk	2
Heater, electric	1
Blender	1
Mortar and pestle	1

Equipment Requirements (Cont'd) -

Jars, pint glass with lids	12
Step ladder	1
Ethylene-glycol, quart	1
Methylene-chloride, quart	1
Poly-ethylene-glycol 600 distearate, quart	1
File cards, 5x8 inches	500
Plastic spray, aerosol cans	2
Tanglefoot, can	1
Paint brushes, small	2

Cost Estimate - Costs will vary with weather conditions, availability of infested shoots, and the trap locations. A preliminary estimate would be:

Laboratory supervisor - 320 hours @ \$3.00	\$960.00
Laboratory aids - 700 hours @ \$2.50	1,750.00
Field man - 320 hours @ \$2.75	880.00
Field man's per diem - 20 days @ \$12.00	240.00
Field man's transportation - 6,000 miles @ .08	480.00
Laboratory transportation - 500 miles @ .08	40.00
Laboratory space rental	250.00
Laboratory lights and heat	25.00
Total	<u>\$ 4,625.00</u>

Timing - The rate of development of shoot moth larvae in infested pines in the Seattle area will vary depending on temperatures during the early spring. Development of the larvae to the pupal stage may be delayed by cool weather until late June.

Operation of the traps during the moth flight period in the Puget Sound area will probably be between June 1 and July 15. Weather conditions will also govern the trap operating period in eastern Oregon and Washington, but it is expected that moth flight will take place from mid-May to July and may even extend into August.

PROCEDURE

Larval Collecting - The collecting of pine shoots infested with the European pine shoot moth will start some time between May 15 and June 15. The collecting period will extend for a two- to three-week period. Weather conditions during early May will determine the proper collecting time and the closer the larvae are to pupation, the less chance there is of mortality from handling. Ten thousand infested shoots will be clipped from pines in the heavily moth-infested areas of Bellevue, Mercer Island, and Seattle. Collecting in certain areas where research work is in progress may be restricted.

All collecting will be done by the rearing laboratory supervisor. He will clip each shoot as close to the base of the bud as possible. Approximately 200 shoots will be placed in a large plastic bag. These bags will be kept in the shade during collecting and while in transit to reduce larval mortality from extreme temperatures. At the laboratory the bags will be kept in a cool place until the shoots are transferred to rearing containers.

Moth Rearing -

1. Infested branch tips collected in the field will be separated into individual infested shoots in the laboratory. Care must be taken not to cut or crush the larvae within the shoots during the operation.
2. Three to ten infested shoots will be placed in each quart milk shake container. The number of larvae per container will vary with shoot size. Containers will have a moist wad of cotton in the bottom and will be covered with a clear plastic perforated top.
3. Containers will be kept in a well-lighted and heated room with the temperature kept between 65° and 75° to hasten larval development.
4. Rearing containers will be separated by date of collection.
5. Several shoots will be opened daily to check on the rate of development of the larvae. It is expected that the earliest collected will be the first to pupate.
6. When three-quarters or more of the larvae in a collection group are pupating, the shoots will be opened and the pupae removed.
7. Each pupae will be examined under a microscope and its sex determined. Five female pupae will be placed in a plastic vial. A small amount of cotton will be placed in the bottom of each vial. This aids the moth in emerging from the pupal case.
8. Vials containing the pupae will be stored at 70° to 75° F. until the moths emerge.
9. Male pupae will be stored in a cool place until required for other studies.

Sex Attractant Preparation -

1. Each day the vials containing the pupae will be examined for moths that may have emerged.
2. Emerged moths will be collected from the vials using the vacuum forceps. The moth will then be held by the head between the thumb and forefinger of the left hand. Using needle nose scissors, clip off 1/8 inch from the end of the moth's abdomen.
3. These cut off abdomen tips will be placed in a mortar. An accurate record will be kept of their number. A minimum of 200 or a maximum of 1,000 will be used in the preparation of a batch of attractant.
4. Before preparing the attractant, stop smoking and be sure there are no open flames in the room. Keep the work area well ventilated.
5. Add a small quantity of methylene chloride to the tips in the mortar and grind until no large particles remain.
6. Add more methylene chloride and mix well.
7. Pour the attractant from the mortar into a graduate cylinder. Wash out mortar with methylene chloride and pour into cylinder. Repeat if necessary to get all attractant particles from mortar.
8. Add methylene chloride to cylinder until there is 5 ml. of attractant solution for each 10 moth abdomen tips used in solution.
9. Add an equal volume of a saturated solution of methylene chloride, poly-ethylene-glycol 600 distearate. There should now be 10 ml. of attractant solution for each 10 abdomen tips used in preparation of the solution.
10. Pour the solution into a blender and mix at high speed for 1 to 2 minutes.
11. Pour the solution into a pint jar. Seal tightly, label with date and quantity of tips used.
12. Place in a refrigerator between 32° and 40° until you are ready to prepare the baits.
13. Each Monday morning enough baits will be prepared for use in all the traps that week. The oldest jar or jars of extract will be removed from the refrigerator and mixed in the blender for 1/2 minute.

14. Baits to hold the sex attractant solution will be prepared from dental cotton packs 6 inches long and 1/2 inch in diameter. These packs will be cut in half forming a bait 3 inches long and 1/2 inch in diameter.
15. Enough cotton baits for the week's use will be submerged in the sex-attractant solution for 1/2 minute each. Baits will be removed and excess attractant allowed to drip off. Each bait should absorb 10 ml. of the sex-attractant solution.
16. The sex-attractant solution should be mixed in the blender for 1/2 minute between the preparation of each ten baits.
17. Enough baits for a trapping location will be placed in a small plastic bag. Exclude as much air as possible and seal with a rubber band.
18. Bags containing baits will be placed in a refrigerated chest for transporting to the field.

Moth Trap Preparation - One hundred traps will be constructed, of which 70 will be in operation and the remainder will be spares. These traps will be constructed from quart cylindrical cardboard ice cream containers. The upper half of each end will be cut out to allow passage of the moths to the bait. The bait will be suspended by a wire from the upper side of the cylinder. The cylinder wall where the bait contacts it will be sprayed with plastic film to prevent the attractant solution from soaking through the cardboard. A sticky paper 4 x 5 inches will be placed in the trap under the bait to hold the moths that are attracted. Heavy cord will be laced through the top of the cylinder at both ends so it may be tied to a branch.

A sign will be printed and attached to the side of each trap. This sign will request that the traps are not to be moved or distrubed. It will also furnish the address and phone number of the agency to contact if information is required.

Trapping Procedure - On Monday morning the field man will report to the rearing laboratory and secure enough baits for all traps for that week. These baits will be carried in a refrigerated box in his vehicle. Traps will be serviced that day at Shelton and Tumwater and he will then travel to Kennewick.

On Tuesday traps will be serviced at Kennewick, Prosser, Walla Walla, and College Place.

On Wednesday traps will be serviced at Hermiston and the field man will return to Seattle.

On Thursday he will report in at the rearing laboratory and prepare records of trap operations and collections.

Servicing of a trap will consist of removing the old bait and inserting a new bait. The sticky cardboard will be removed and replaced if any moths are trapped. Sticky boards with any trapped moths will be labeled for date and location and returned to rearing laboratory.

Records and Reports - The laboratory supervisor will keep a record of the following:

1. The hours he works.
2. The hours the laboratory aids work.
3. Operating mileage on his State-owned vehicle.
4. Collecting dates and numbers of infested shoots.
5. Dates when the pupae are removed from these shoots.
6. The date when moths start to emerge.

The field man will keep a record of the following:

1. The hours he works.
2. The hours he is in travel status.
3. Operating mileage on the State-owned vehicle.
4. Dates which traps are in operation.
5. Number of shoot moths trapped by trap, date and location.

At the conclusion of the survey, a complete report will be compiled of the procedures used, costs, and results.